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DRYDEN CENTERWIDE PROCEDURE

CODE SH

CONFINED SPACE

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Chief, Safety, Health, and Environmental Office

DOCUMENT HISTORY PAGE

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DATE APPROVED	ISSUE	PAGE	AMENDMENT DETAILS
2-9-99	Baseline		
3-9-00	Revision A	All	Entire document modified.
See IDMS Document Master List	Revision B	Various	Added text to 4.2, Directorates and Single Letter Offices. Title of section 5.0 changed to "Confined Space Safety Program". Added "5.1.1, Signage" and "5.2.1, Signage". Cosmetic changes throughout as directed.

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CONFINED SPACE FORMS

1.0 INTRODUCTION

1.1 Purpose

This DCP provides procedures and documentation requirements that implement safety controls for confined space operations at DFRC and at DFRC controlled off-site locations.

1.2 Applicability

This DCP applies to government and non-government personnel at DFRC and at DFRC controlled off-site operations.

1.3 Scope

This Dryden Centerwide Procedure (DCP) defines responsibilities, and establishes procedures to ensure control and protection of personnel when engaged in confined space operations.

2.0 APPLICABLE DOCUMENTS

2.1 Authority Documents

NPD 8710.2B, NASA Safety and Health Program Policy. This NPD establishes the requirements for the NASA wide safety and health program and is the authority for this DCP.

29 Code of Federal Regulations (CFR), Part 1910.146, Permit-Required Confined Spaces. This CFR is the primary authority document for confined space procedures.

29 Code of Federal Regulations, Part 1910.268, Telecommunications. This CFR provides guidance to persons working in telecommunication vaults, sewers, and joint power manholes and vaults.

2.2 Guideline Documents

ANSI Z117.1, Safety Requirements for Confined Spaces. This standard is an excellent reference for the actions required prior, during and post confined space entry.

Title 8, California Code of Regulations; Article 108, Sections 5156-5157
This Code follows **29 CFR 1910.146** closely.

National Institute for Occupational Safety and Health , 80-106, Criteria for a Recommended Standard - Working in Confined Spaces.

National Institute for Occupational Safety and Health, 87-113, A Guide to Safety in Confined Spaces.

3.0 DEFINITIONS

3.1 Acceptable Entry Conditions: conditions that must exist in a confined space to allow entry and to ensure that employees involved can safely enter into and work within the space.

3.2 Attendant: an individual stationed outside one or more permit spaces who monitors the Entrants and who performs all attendant's duties assigned in the employer's permit space program.

3.3 Blanking or Blinding: the absolute closure of pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

3.4 Checklist : a document that is provided to allow entry into a non-permit confined space. Dryden Non-Permit Confined Space Checklist is DFRC-224.

3.5 Confined Space : a space that:

- is large enough and so configured that an employee can bodily enter and perform assigned work and;
- has limited or restricted means for entry or exit (for example, tanks, vessels, fuel cells, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry) and;
- is not designed for continuous employee occupancy.

3.6 Double Block and Bleed: the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

3.7 Emergency: any occurrence (including any failure of hazard control, or monitoring equipment) or event internal or external to the confined space that could endanger Entrants.

3.8 Engulfment: the surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

3.9 Entrant: an employee who has the required training and is authorized by the employer to enter a confined space.

3.10 Entry: the action by which a person passes through an opening into a confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

3.11 Entry Permit: a document that is provided by the employer to allow and control entry into a permit required space. Dryden Confined Space Entry Permit is DFRC-223.

3.12 Entry Supervisor:

- individual (such as the employer, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a confined space where entry is planned.
- has the authority to authorize entry and to oversee entry operations.
- has the authority to order evacuation, terminate entry and must sign the entry checklist or permit.
- may serve as an attendant or entrant as long as he/she is trained and equipped for that position as required by this DCP.

3.13 Hazardous Atmosphere: an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a confined space), injury, or acute illness. A hazardous atmosphere may contain toxic gasses or vapors, inerting gasses, reduced or increased oxygen, explosive or flammable substances.

3.14 Exposure Limits: NASA uses 29 CFR Part 1910.1000 Subpart Z, Toxic and Hazardous Substances which sets Permissible Exposure Limits (PEL) and American Conference of Governmental Industrial Hygienist (ACGIH) which establishes Threshold Limit Values (TLV®). Exposure limits for some substances have not been made by OSHA or ACGIH. There are sources of information, such as Material Safety Data Sheets that comply with the Hazard Communication Standard, 29 CFR 1910.1200, published information, and internal documents that may provide guidance in determining acceptable conditions. The Safety Office

shall be contacted anytime information is not available or there is a question regarding a substance.

3.15 Hot Work Permit: the employer's written authorization to perform operations (for example, riveting, welding, cutting, burning, and heating) capable of providing a source of ignition. For DFRC this permit is AF Form 592, which must be filled out by the employee and approved by the Safety Office before hot work is started.

3.1 Immediately Dangerous to Life or Health (IDLH): any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a confined space.

3.17 Inerting: the displacement of the atmosphere in a permit space by an inert gas (such as nitrogen) to such an extent that the resulting atmosphere is non-combustible. This will produce an IDLH condition.

3.18 Isolation: the process by which a confined space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; miss-aligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

3.19 Line breaking: the intentional opening of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material, inert gas, or any fluid at a volume, pressure, or temperature capable of causing injury.

3.20 Non-Permit Confined Space: confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazards capable of causing death or serious physical harm.

3.21 Oxygen Deficient Atmosphere: an atmosphere containing less than 19.5 percent oxygen by volume.

3.2 Oxygen Enriched Atmosphere: an atmosphere containing more than 23.5 percent oxygen by volume.

3.23 Permit-Required Confined Space (permit space): a confined space that has one or more of the following characteristics:

- contains or has potential to contain a hazardous atmosphere or;
- contains a material that has the potential for engulfing an entrant or;

- has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section or;

- contains any other serious safety or health hazard.

3.24 Permit-Required Confined Space Program : the employer's overall program for controlling and protecting employees from permit space hazards and for regulating employee entry into permit required spaces.

3.25 Prohibited Condition: any condition in a confined space that is not allowed by the permit or checklist during the period when entry is authorized.

3.26 Rescue Service: the personnel designated to rescue employees from confined spaces.

3.27 Retrieval System: safety equipment including a retrieval line, full-body harness, wristlets and a lifting device or anchor used for non-entry rescue of persons from confined spaces.

3.28 Testing: The process by which the hazards that may confront Entrants of a confined space are identified and evaluated. Testing includes specifying the tests that are to be performed in the confined space. Testing enables employers both to devise and implement adequate control measures for the protection of Entrants and to determine if acceptable entry conditions are present immediately prior to and during entry.

4.0 ROLES and RESPONSIBILITIES

4.1 Overview

The chain of responsibility for ensuring that there is a safe work environment at DFRC that follows required safety standards, regulations, codes, and guidelines starts with the Center Director and flows downward through management and supervisors. In addition, each person who works at DFRC must understand that a "condition of employment" is to observe all safety specifications applicable to the task being performed.

4.2 Directorates and Single Letter Offices

Directorates and Single Letter Offices are responsible for ensuring that risk assessments of potential confined spaces within their area of responsibility are made and, when confined spaces are determined to exist, to control entry in accordance with this DCP and applicable documents. This includes identifying to

the Safety Office new confined spaces that have been created in order for a classification of the space to be made by the Safety Office. The Safety Office will advise the owner as to how the space was classified (non-Permit Confined Space or Permit Required Confined Space.) Upon classification, a sign must be posted by the Directorate or single-letter office in order to alert potential entrants.

4.3 Chief, Safety, Health, and Environmental Office

The Chief, Safety, Health, and Environmental Office has oversight responsibility for confined space entry and as such incurs the following responsibilities:

- develop and maintain a confined space safety program for DFRC.
- include organizational confined space activity as part of safety inspections.
- investigate confined space accidents and incidents and report them to management and required agencies.
- issue confined space checklists and permits

4.4 Entry Supervisor

The Entry Supervisor is the "foreman" of the confined space operation and as such has the following responsibilities when entry into a confined space is required:

- with the assistance of the Safety Office Industrial Hygienist (IH), complete DFRC-223, Confined Space Entry Permit.
- review the confined space and project hazards, with the IH for the confined space to be entered. This information is located in the Safety Office.
- make DFRC-223 available to employees and post the form near the entry point of the confined space.
- verify that entry personnel and attendants are qualified, required forms are complete, necessary pre-entry tests have been done, required PPE is worn by Entrants, and necessary equipment is in place including non-entry rescue, and communications equipment when required.
- ensure that conditions are monitored, do not degrade from initial evaluation, and remain consistent with the entry permit.
- ensure hazards listed on DFRC-223 are controlled or eliminated.

- providing appropriate barriers to isolate the area and protect entrants from external hazards. Remove unauthorized individuals who enter or who attempt to enter the secured area.

- order evacuation of the confined space and cancel the permit when unsafe conditions exist or the task is completed. Return permit, and test equipment to the Safety Office when the task is terminated.

4.5 Attendant

The attendant is stationed outside a permit required confined space to monitor the conditions of Entrants. The attendant will be in communication with the Entrants and have the following responsibilities:

- be aware of the hazards that may be faced during entry, including physical and behavioral changes in Entrants and know the consequences of exposure.

- maintain entrant identification and effective communication with all Entrants.

- monitor entry activities and watch for prohibited conditions both inside and outside the confined space. Entrants may not be assigned another duty that could possibly be a distraction. Attendants will not leave their location unless relieved by another qualified attendant.

- the attendant will order the Entrants to cease operation and exit the confined space when:

    1. a prohibited condition exists.
    2. a behavior or other unusual condition in the Entrants is detected.
    3. an unsafe condition occurs inside or outside of the permit space.
    4. unable to perform all necessary duties.

- initiate on-site rescue procedures and notify emergency rescue service if necessary.

4.6 Entrants

All Entrants who enter a confined space shall know the potential hazards that may be encountered during entry and the proper use and limitations of equipment to control those hazards. Other responsibilities include:

- Communicate with the attendant if required to enable the attendant to maintain current status of entry operations. The Entrants will notify the attendant whenever:

  1. the entrant recognizes any warning sign or symptom of exposure to a dangerous substance or;
  2. the entrant detects a prohibited or dangerous condition.

- Entrants will exit from the confined space quickly and safely whenever:

  1. an order to evacuate is given.
  2. the entrant recognizes any warning sign or symptom of exposure to a dangerous situation.
  3. the entrant detects a prohibited condition.
  4. an evacuation alarm is activated.
  5. an air monitor indicates an unsafe atmosphere, (when an air breathing source is not used).

4.7 Contracting Officer (CO)

4.7.1 Off-site Contractors

Off-site contractors involved in confined space entry will be informed of the following by the Contracting Officer:

- that confined space entry is allowed only through compliance with the contractor's approved confined space entry program or this DCP. If the contractor's program is used it must be approved by the Safety Office.

- of the elements that make the space a confined space, including hazards identified and DFRC's experience with the space.

- coordinating entry operations with both the on-site and off-site contractors when both will be working in or near confined spaces.

4.7.2 Multiple Contractors

If more than one contractor will be entering the confined space the DFRC line supervisor or Contracting Officer Technical Representative (COTR) responsible for the project will coordinate entry operations and ensure that each contractor is aware of the operations of the other(s) and that each contractor has been issued and signed their own NASA entry permit or checklist. A qualified Entry Supervisor will be selected to oversee entry operations.

4.7.3 Documentation

The CO shall request necessary documentation from the contractor, such as training records, PPE training, etc., prior to start of work. Off-site contractor personnel are not required to have a medical clearance for confined space entry.

5.0 CONFINED SPACE SAFETY PROGRAM

5.1 Non-permit Confined Space Entry Control

If the only hazard in the confined space is the atmosphere and it can be eliminated or controlled by ventilation, the confined space may be classified as non-permit. There are, however, entry control procedures to ensure the safety of Entrants.

5.1.1 Signage A Caution sign shall be posted at all non-permit confined spaces by the facilities organization under the direction of the Safety Office. The purpose of the sign is to inform employees of the classification of the confined space.

5.1.2 Pre-entry Before entry into a non-permit space is authorized the Designated Entrant shall, with the assistance of a Safety Office IH, complete DFRC-224, Non-Permit Confined Space Checklist.

5.1.3 Checklist - DFRC-224 will be made available, at the time of entry, to all Entrants by posting it at the portal or by any other equally effective means in order that the Entrants can confirm entry preparations have been completed.

5.1.4 Form Duration The effective time of DFRC-224 shall not exceed the time required to complete the task identified. The duration must not extend beyond one shift with the same crew. If a new crew arrives, new forms must be completed by the new entrant.

5.2 Permit Space Entry Control

Entry control may be enhanced by the use of area or job specific procedures. Work often involves trade-skilled individuals that must routinely work in areas that are permit required confined spaces. In some cases the work is preventative maintenance, which has specific written work procedures. In this case, the confined space safety requirements may be added to the written work procedures as long as they meet the requirements of this DCP and are approved by the Safety Office.

5.2.1 Signage A Danger sign shall be posted at all permit-required confined spaces by the facilities organization under the direction of the Safety

Office. The purpose of the sign is to inform employees of the danger posed by the permit-required confined space.

5.2.2 Pre-Entry Before entry into a permit space is authorized the Entry Supervisor shall, with the assistance of a Safety Office IH, complete DFRC-223, Confined Space Entry Permit.

5.2.3 Permit DFRC-223 will be made available, at the time of entry, to all Entrants and attendant(s) by posting it at the portal or by any other equally effective means in order that the Entrants and attendant can confirm entry preparations have been completed.

5.2.4 Form Duration The effective time of DFRC-223 shall not exceed the time required to complete the task identified. The duration must not extend beyond one shift with the same crew. If a new crew arrives, new forms must be completed by the new entry supervisor.

5.2.5 Permit Termination

- The task covered by the permit has been completed.
- A condition not allowed under the permit or this DCP arises in or near the confined space.

5.2.6 Entry Review The entry supervisor shall note any problems encountered during the entry on DFRC-223 so that appropriate revisions to the confined space program may be made. DFRC-223 will be returned to the Safety Office within three (3) days of termination.

5.3 Re-classification of Confined Spaces

5.3.1 Permit Space to Non-permit Space If it is necessary to enter a confined space to eliminate hazards such entry shall be performed under permit space entry procedures. If testing and inspection demonstrates that the hazards within the permit space have been eliminated, the permit required confined space may be re-classified as a non-permit space for as long as conditions remain safe.

5.3.2 Non-permit Space to Permit Space When there is a change in the use or configuration of a non-permit space that increases the hazard to Entrants the Safety Office will be notified. The Safety Office will re-evaluate the space and, if necessary re-classify it as a permit required confined space.

5.3.3 Documentation The re-classification of a confined space will be documented on DFRC-225, Confined Space Evaluation, for permanent reclassification and placed on file in the Safety Office. For temporary

reclassification the notation will be made on the appropriate form (DFRC-223 or DFRC-224) and placed on file in the Safety Office.

6.0 SAFETY PRECAUTIONS

6.1 Confined Space Hazards

Confined space hazards fall into two (2) general categories; hazardous atmospheres and physical hazards.

6.1.1 Atmospheric Hazards

Table 1

Hazard	Description	Comments
O_2 Deficiency	Less than 19.5 % by volume	May cause light-headedness dizziness or unconsciousness
O_2 Increase	Greater than 23.5 % by volume	Increases flammability and explosion possibilities.
Hydrogen Cyanide	Poisonous gas	Has a bitter almond odor
Hydrogen Sulfide	Toxic gas	Has a rotten egg odor
Methane	Toxic, flammable and explosive	Has no odor
Freon	May be toxic depending on type	Displaces breathing air
Vapors from jet fuels, gasoline, solvents, and other carbon-based liquids	Usually toxic, flammable and explosive	Get up-wind from vapors
Dusts & flyings	May be explosive	May damage respiratory system
Carbon Dioxide (CO_2) & Nitrogen (N_2)	Can concentrate in low places	Displaces breathing air
Carbon Monoxide (CO)	Toxic gas	Replaces O_2 in the blood. Can be fatal.
Fumes, vapors, gases, and mists.	Welding, cutting, flames, sparks, etc.	Work being done may change the classification of the space

See 29 CFR 1910.1000 Subpart Z Toxic and Hazardous substances, or current ACGIH TLV® for other toxic and hazardous substances and exposure limits.

6.1.2 Test of Conditions

- Conditions must be tested in a confined space to determine if acceptable entry conditions exist before entry is authorized.
- If isolation of the space is not feasible because the space is large or is part of a continuous system, such as a sewer, pre-entry testing shall be performed to the extent feasible before entry is authorized and, if entry is authorized, entry conditions shall be continuously monitored in the area where Entrants are working.

- If a hazardous atmosphere could be created by the work being done such as welding, cutting, brazing, open flames, etc., atmospheric monitoring will be continuous.

6.1.3 Test Sequence: When testing for atmosphere hazards it is CRITICAL that the
testing order below be followed.
1. Oxygen
2. Combustible gases and vapors
3. Toxic gases and vapors.

6.1.4 Ventilation: Entrants will not enter a confined space that contains a hazardous atmosphere without appropriate respirators. The hazardous atmosphere must be eliminated by forced ventilation in order for the space to be classified as a non-permit confined space. The airflow shall be directed to ventilate the immediate area where the Entrants are to be in the space and shall start 30 minutes prior to entry and continue until all Entrants have left the space. The air supply shall be from a clean source and may not increase the hazards of the space. The atmosphere shall be tested periodically or as directed by the permit or checklist to ensure the ventilation is adequate. Should a hazardous atmosphere be detected each Entrant will evacuate the space. The reason for the atmosphere change will be determined and corrected before Entrants may re-enter the space.

6.1.5 Physical Hazards

Table 2

Hazard	Description	Comments
Electrical	Electrical transmission line, equipment or machines	Lockout or tagout (LOTO) procedures may be required
Thermal energy	Heat, steam, or hot atmosphere	May require ventilation, LOTO, etc.
Becoming lodged	Space becomes narrower, slopes downward	Area requires a survey before entering and the use of an extraction harness
Falling objects	Debris, or tools that can fall into a space	Isolate openings. Hard hats required and other precautions need to be taken
Falls	Falls from ladders or other support equipment	Use proper support equipment
Noise	Noise may be excessive where equipment or machinery is located in a confined space	Wear hearing protection where required, however, Entrants must have a means of hearing the attendant
Engulfment	See definition, paragraph 3.8	
Ionizing and non-ionizing radiation	May be from microwave equipment, etc.	See DCP-S-023 and DCP-S-024
Hot Tap, welding, brazing, etc.	Open flames, sparks	May require additional permits. Fuel tanks may not be left in confined space when not in use

Some physical hazards may not be apparent on entry unless a thorough evaluation of the site has been made.

7.0 RESCUE (Confined Space)

7.1 First Aid & CPR

For entry involving DFRC personnel, either the entry supervisor or the attendant will hold a current certification in First Aid and CPR.

7.2 Retrieval System

To facilitate non-entry rescue, a suitable retrieval system shall be used whenever an entrant enters a permit required confined space unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant.

7.3 Retrieval Harness

Entrants will use full body harness, with a retrieval line attached behind the center of the entrant's back or above the head. Wristlets may be used in lieu of the full body harness if the employer can demonstrate that the use of a full body harness is not feasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative. Wristlets should not be used to lift a person's full weight.

7.4 Retrieval Line

The end of the retrieval line shall be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. A mechanical device shall be available to retrieve personnel from vertical permit spaces more than 5 feet deep.

7.5 Rescue Notification

If in the course of a permit required space entry, an attendant becomes aware that an entrant needs assistance in evacuating, the attendant shall summon rescue and other emergency services and begin non-entry rescue procedures.

7.6 Attendants

Attendants may enter a permit required space to attempt a rescue only if they have been certified, trained and properly equipped for rescue operations, and if they have been relieved by another attendant.

7.7 Toxic Materials

If an injured entrant is exposed to a substance for which a material safety data sheet (MSDS) or similar written information is required to be kept at the work site, that MSDS or written information shall be made available to the medical facility treating the exposed entrant.

8.0 MEDICAL CLEARANCES

8.1 Medical Clearances for Confined Spaces

DFRC and on-site contractor Entrants who enter confined spaces will receive medical clearances annually. Medical clearances will be completed prior to training unless otherwise approved. On-site contractor Entrants are authorized to receive medical clearance from the DFRC Health Unit.

8.2 Medical Clearance for Respirators

Persons requiring the use of respirators will receive medical clearance and training as directed by DCP-S-036, Respiratory Protection.

9.0 TOOLS, EQUIPMENT, AND MATERIALS

Each confined space entry will offer different conditions that must be controlled. When a proper hazard analysis is made of the confined space these conditions should become evident, therefore, allowing actions to be taken to control them. Following is a list of items that must be available as conditions require:

- atmosphere testing and monitoring equipment
- air exchangers and ventilation equipment
- Personal Protective Equipment such as:
  - Respiratory equipment
  - Gloves
  - Hard hats
  - Face shields or safety glasses
  - Special footwear
  - Coveralls
- communication equipment
- lighting (explosion proof if necessary)
- barriers
- ladders or other types of entry and exit devices
- non-entry rescue equipment such as:
  1. harness
  2. retrieval line

3. wristlets

10.0 TELECOMMUNICATIONS FIELD WORK

This section applies to the guarding of utility vaults and street openings, and to atmospheric testing and ventilation in utility vaults and non-vented vaults where telecommunications field work is performed on or with underground lines. See 29 CFR 1910.268, Telecommunications.

10.1 Guarding Utility Vaults and Street Openings

When covers of utility vaults or street openings are removed, the opening shall be promptly guarded by a railing, temporary cover, or other suitable temporary barrier which is appropriate to prevent an accidental fall through the opening, and to protect employees working in the utility vault from foreign objects entering the opening.

10.2 Requirements Prior to Entering Utility Vaults and Non-Vented Vaults

Before an employee enters a utility vault, the following steps shall be taken:

- the internal atmosphere shall be tested for oxygen deficiency, combustible gases, and toxic gases.
- when unsafe conditions are detected by testing or other means, the work area shall be ventilated and otherwise made safe before entry.

10.3 Air Supply

An adequate continuous supply of air shall be provided while work is performed in utility vaults under any of the following conditions:

- where combustible or explosive gas vapors have been initially detected and subsequently reduced to a safe level by ventilation, or;
- where solvents or other hazardous materials are used in the work procedure, or;
- where open flame torches are used in the work procedure, or;
- where the utility vault is located in that portion of a public right of way open to vehicular traffic and/or exposed to a seepage of gas or gases, or;
- where a toxic gas or oxygen deficiency is found.

10.4 Joint Power and Telecommunication Utility Vault

10.4.1 First Aid and CPR

An employee with basic first aid and CPR training shall be available in the immediate vicinity to render emergency assistance when work is being performed in a utility vault occupied jointly by an electric and telecommunication utility. This employee is not precluded from occasionally entering a utility vault to provide assistance other than in an emergency. The requirement of this section does not preclude a qualified employee working alone from entering, for brief periods of time, a utility vault where energized cables or equipment are in service for the purpose of inspection, housekeeping, taking readings, or similar work when such work can be performed safely.

10.4.2 Ladders

Ladders shall be used to enter and exit utility vaults exceeding 4 feet in depth.

10.4.3 Open Flames

When open flames are used in utility vaults, the following precautions shall be taken to protect against the accumulation of combustible gas:

- a confined space permit is required.
- a test for combustible gas shall be made immediately before using the open flame device and continuously while using the device.
- a fuel tank (e.g., acetylene, etc.) may not be in the utility vault except during actual use.
- a welding, cutting and brazing permit (AF Form 592) shall be filled out and approved by the Safety Office prior to performing any work that creates a flame or spark. Precautions shall be taken to guard against a build up of combustible, toxic gases, fumes, mists, etc., when open flames or welding operations are being done in vaults.

10.4.4 Microwave Equipment

Microwave equipment may be found in underground vaults and tunnels. These sites shall be properly posted with warning signs. Radiation exposure limits will not be exceeded. See DCP-S-024, Non-Ionizing Radiation , and ANSI/IEEE C95.3, Measurement of Potential Hazardous Electrical-Magnetic Fields - RF and Microwave, for additional information.

10.5 Sewers

10.5.1 Sewer Entry

Working in sewers differs in three vital respects from other permit required confined space entries. They are:

- there is rarely a means to isolate the space;
- the atmosphere cannot be controlled and, therefore, may suddenly and unpredictably become lethal beyond control of the entrant;
- experienced sewer workers are especially knowledgeable in entry and work in their permit spaces because of their frequent entries.

10.5.2 Atmosphere Monitoring

To ensure safety while in sewer systems, the atmosphere will be monitored continuously with equipment that sounds an audible alarm when the atmosphere becomes out of limit for one of the following:

- Oxygen below 19.5 or above 23.5 percent.
- Flammable gas or vapor at 10% or more of the lower flammable limit.
- Hydrogen sulfide at 10 PPM and carbon monoxide at 25 PPM.

11.0 TRAINING AND CERTIFICATION

11.1 Training Requirements

Entrants, Attendants, Entry Supervisors, and rescue service members shall be qualified for the position they fill. Training records shall include each employee's name, the signatures or initials of the trainers, and the dates of

training. Training records and medical approvals will be available for inspection by authorized confined space team members and their authorized representatives. Training shall, at a minimum, include the following:

- the operation of the confined space entry program.
- the specific duties of each person involved in confined space operations.
- the hazards of confined spaces including information on the mode, signs or symptoms, and consequences of exposure.
- the proper use of equipment required during confined space operations including testing and monitoring equipment, ventilating equipment, communication equipment, personal protective equipment, lighting equipment, barriers and shields, ingress/egress equipment, rescue and emergency equipment used for non-entry rescue.
- the methods and importance of communication between entrant and attendant.
- the conditions under which the space must be evacuated.
- the procedures for summoning rescuers.
- the procedures to be used for a non-entry rescue.
- each member of the confined space entry team at DFRC will receive biannual training.

11.2 Safety Office

Will provide confined space training to DFRC personnel and on-site contractors. Off-site contractors will make appropriate arrangements for training and documentation in accordance with 29 CFR 1910.146.

11.3 Additional Training Additional training will be required when:

- there is a change in confined space operations that presents a hazard about which an employee has not previously been trained.
- deviations from the confined space entry procedures occur or when there are inadequacies in the employee's knowledge or use of confined space entry procedures.

12.0 RECORDS

12.1 Confined Space Records

Table 3

Record or Form #	Title	Responsibility for Completion	File Location
DFRC-223	Confined Space Entry Permit	Customer & Safety Office	Safety Office
DFRC-224	Non-permit Confined Space Checklist	Customer & Safety Office	Safety Office
DFRC-225	Confined Space Evaluation	Customer & Safety Office	Safety Office
N/A	Medical Approval	Customer & Health Unit	Safety Office & Health Unit
N/A	Training Records	Customer & Instructor	Customers organizational training file

12.2 Retention and Archive

Records will be maintained and archived in accordance with NPG 1441.1, RECORDS RETENTION SCHEDULES.

13.0 CONFINED SPACE PROCEDURES

Start Procedures

13.1 Permit Required Confined Space Entry.

Entry Supervisor

☐ 1. Complete DFRC-223, Confined Space Entry Permit. Permit must be approved by the Safety Office before entry is allowed. Obtain necessary testing equipment from Safety Office. Insure monitoring equipment is calibrated.

☐ 2. Verify that attendants and Entrants are qualified (training and medical clearance) and that proper PPE and required safety equipment is available and serviceable.

☐ 3. Ensure that conditions are monitored periodically or continuously as required to see they do not degrade from initial evaluation and that the operations remain consistent with the terms of the entry permit.

☐ 4. Remove unauthorized persons who enter or attempt to enter the confined space or secured area during entry operations.

☐ 5. Order evacuation of the space and cancel the permit when unsafe conditions exist or the task is completed. Return permit and test equipment to the Safety Office.

Attendants

☐ 1. Ensure Entrants are properly equipped and that pre-entry testing and measurements have been taken prior to entry.

☐ 2. Maintain entrant identification and effective communication with all Entrants.

☐ 3. Monitor entry activities and watch for prohibited conditions both inside and outside the confined space. Keep unauthorized persons away from entry site.

☐ 4. Order Entrants to cease operation and exit confined space when:

- a prohibited condition exists.
- a behavior or other unusual condition in an entrant is detected.
- an unsafe condition occurs inside or outside the permit space.
- unable to perform all necessary duties. In an emergency, initiate on-site rescue and notify rescue services if necessary.

Entrants

☐ 1. Ensure that proper PPE is worn and functional and that required equipment is on site and functional.

☐ 2. Communicate with attendant to enable the attendant to maintain current status of operation.

☐ 3. Emergencies:
Notify the attendant when:

- any warning signs or symptoms of exposure to a substance is noted.
- a prohibited or dangerous condition is detected.

Evacuate when:

- an order to evacuate is given.
- a warning sign or symptom of exposure is recognized.

- a prohibited condition is detected.
- an evacuation alarm is activated.
- atmosphere monitoring equipment indicates an unsafe atmosphere (where an air breathing device is not used).

13.2 Non-permit Confined Space Procedures

Entrant

☐ 1. Complete DFRC-224, Non-permit Confined Space Checklist, at the Safety Office.

☐ 2. Post DFRC-224 at the confined space entry point.

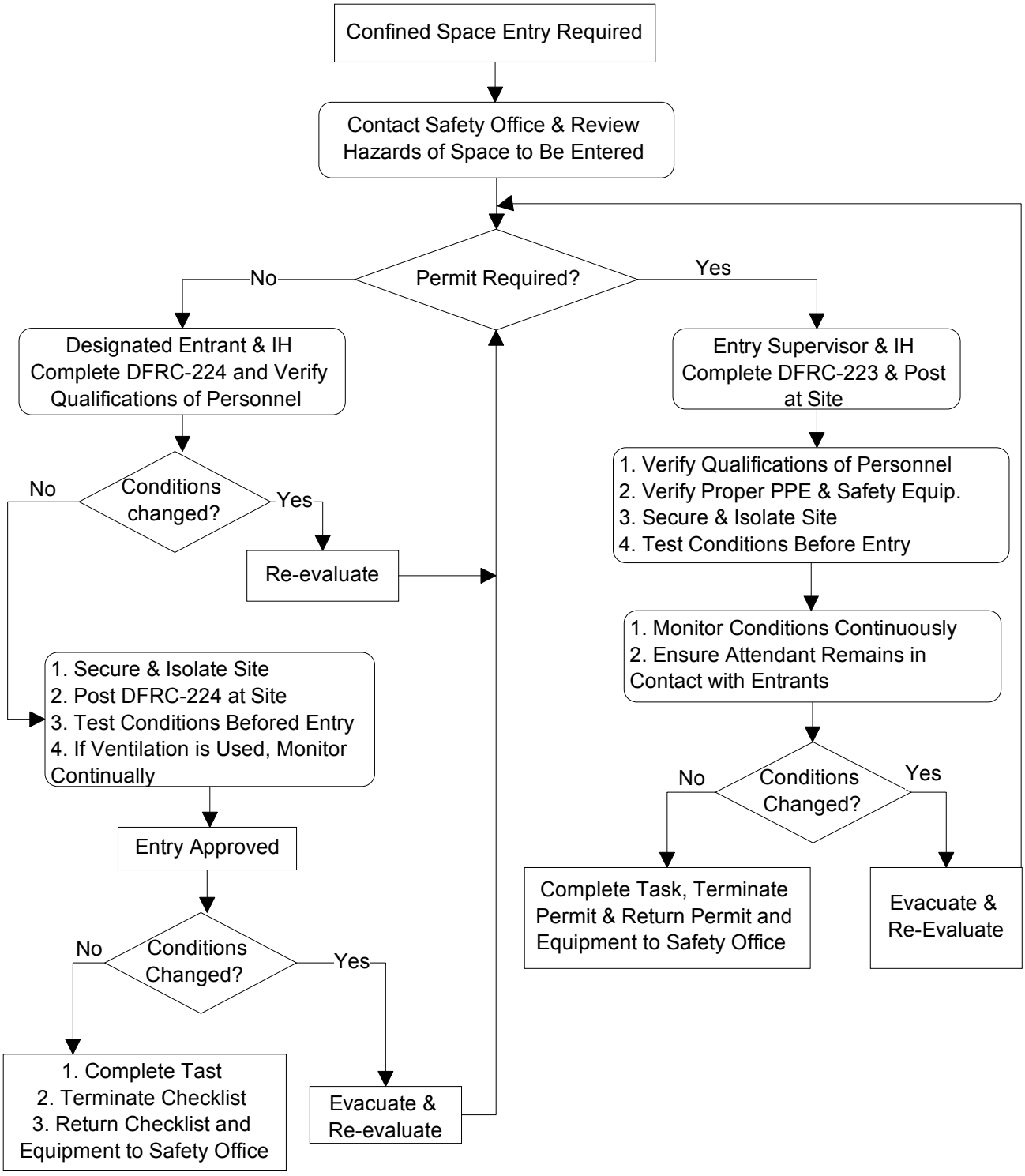
☐ 3. Test atmosphere prior to entry.

☐ 4. If the confined space is maintained by the use of ventilation the atmosphere will be continually measured.

☐ 5. Monitor activities while in the confined space and evacuate if an unsafe condition occurs and eliminate the unsafe condition before re-entering. If unsafe conditions cannot be quickly eliminated contact the Safety Office.

☐ 6. Terminate the confined space operation when the task is completed or an unsafe condition occurs. Return test equipment to the Safety Office.

APPENDIX A
Confined Space Entry Flowchart


Confined Space Entry Required
Contact Safety Office & Review Hazards of Space to Be Entered
Permit Required?
No
Yes
Designated Entrant & IH Complete DFRC-224 and Verify Qualifications of Personnel
Conditions changed?
No
Yes
Re-evaluate
1. Secure & Isolate Site
2. Post DFRC-224 at Site
3. Test Conditions Befored Entry
4. If Ventilation is Used, Monitor Continually
Entry Approved
Conditions Changed?
No
Yes
1. Complete Tast
2. Terminate Checklist
3. Return Checklist and Equipment to Safety Office
Evacuate & Re-evaluate
Entry Supervisor & IH Complete DFRC-223 & Post at Site
1. Verify Qualifications of Personnel
2. Verify Proper PPE & Safety Equip.
3. Secure & Isolate Site
4. Test Conditions Before Entry
1. Monitor Conditions Continuously
2. Ensure Attendant Remains in Contact with Entrants
Conditions Changed?
No
Yes
Complete Task, Terminate Permit & Return Permit and Equipment to Safety Office
Evacuate & Re-Evaluate

CONFINED SPACE FORMS

See following pages for:

CONFINED SPACE ENTRY PERMIT

Permit must be **POSTED** at job-site until work is completed. _____
Control Number

I. Confined space location: _____ _____
DATE

Permit valid this date only: From: _____ To: _____

Entrants:	Attendants:	Fire Watch (Open Flame)
1. _____	1. _____	1. _____
2. _____	2. _____	
3. _____		
4. _____		

Description of Job or Special procedures:
_____
_____
_____

V. Hazards Expected: (Describe or Indicate N/A)

_____Atmosphere _____
_____Hazardous Energy _____
_____Hot/Cold work _____
_____Radiation _____
_____Engulfment, Entrapment _____
_____Corrosives _____
_____Flammables _____
_____Inert Gases _____
_____Toxics _____
_____Spark Producing _____
_____Activities increase hazard _____
_____Other hazards _____

V. Special Requirements: (Describe or Indicate N/A)

_____Personal Protective Equipment: _____
_____Communication (required)_____
_____Lighting _____
_____Safety Instructions _____
_____Monitoring _____
_____Ventilation _____
_____Fire Extinguisher _____

_____Barricades, Etc. _____
_____Retrieval/Fall/Arresting Equip. _____
_____Safety Harness/Wristlets _____
_____First Aid/CPR _____
_____GFCI Device _____
_____Contact EAFB Fire Dept._____

V. Atmospheric Tests

Acceptable Range	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	Test 8
Oxygen % 23.5 to 19.5								
Flammability <10 % LEL								
CO<12 ppm								
H_2S 5ppm								
Other <1/2 PEL								
Tester Initials								
Time								
Instrument Make, Model No.	Serial No.		Calibration Date			Conditions Measured		

Comments:

_____

V. Permit Approval

Entry Supervisor is responsible for ensuring that all necessary procedures, practices, and equipment for safe entry are in place before and during entry.

Permit Requested by: _____ Org. _____ Date: _____
Permit Completed by: _____Org. _____ Date: _____
_____Date: _____
Entry Supervisor
_____Date: _____ _____ _____
DFRC Industrial Hygienist I H Review Date

Permit terminated: Time: _____ Date: _____ Initials: _____

_____ Date: _____
Reviewed by (following completion)

Return permit to Safety Office when work is completed.
DFRC-223
Dec 1999

NON-PERMIT CONFINED SPACE CHECKLIST

Control Number: _____

Industrial Hygienist: _____Location: _____Date: _____

Entrants Name/Organization

1. _____/_____ 3. _____/_____
2. _____/_____ 4. _____/_____

- Will operations introduce contaminants into the space which change the atmospheric quality and characterization of the space? Yes ☐ No ☐
- Do conditions exist outside the space that could adversely affect the entry? Yes ☐ No ☐

If Yes, on either item, the conditions must be eliminated prior to entry or re-evaluate for Permit Required Confined Space Entry.

Secure the work site: Initials: _____
Post the area with appropriate signs: Initials: _____

Acceptable Range	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	Test 8
Oxygen % 23.5 to 19.5								
Flammability <10 % LEL								
CO<12 ppm								
H_2S 5ppm								
Other <1/2 PEL								
Tester Initials								
Time								

Instrument Make, Model No.	Serial No.	Calibration Date	Conditions Measured

Purge/Ventilate. Yes ☐ No ☐ Initials: _____
Re-test after ventilation. Yes ☐ No ☐ N/A ☐ Initials: _____
Is continuous monitoring recommended inside the space: Yes ☐ No ☐ Initials: ____
Is continuous ventilation recommended for duration of operation: Yes ☐ No ☐ Initials: ____

_____/_____ Date: _____
Entry Supervisor / Org.

_____ Date: _____
DFRC Industrial Hygienist

_____ Date: _____
Reviewed By (Following Completion)

DFRC-224
Dec 1999

CONFINED SPACE EVALUATION

Identification #: _____ Date: _____
Space Owner: _____ Location: _____
Dimensions: _____
Description: _____
Type of Evaluation (Check One): Initial ☐ Re-evaluation ☐

Does the space meet the definition of a confined space? Yes ☐ No ☐
If no, evaluation is complete and space is not a confined space (indicate below). Sign, date, and file the evaluation form.
If yes, determine if the space is a Non-Permit Confined Space or Permit Required Confined Space.

Hazard Identification

The hazard identification process shall be performed by Industrial Hygienist and shall include:

- Oxygen deficiency? Yes ☐ No ☐
- Oxygen enrichment? Yes ☐ No ☐
- Flammable gases or vapors present? Yes ☐ No ☐
- Toxic gases or vapors present? Yes ☐ No ☐
- Possibility of engulfment? Yes ☐ No ☐
- Biological hazards present? Yes ☐ No ☐
- Mechanical hazards present? Yes ☐ No ☐
- Electrical (high voltage) hazards? Yes ☐ No ☐
- Gas lines present? Yes ☐ No ☐
- Past history of hazardous atmosphere? Yes ☐ No ☐
- Potential for near-by activities to make entry hazardous? Yes ☐ No ☐
- Oxygen content (percent); _____ % • H_2S _____ ppm
- Flammability determination; _____ %LEL • CO _____ ppm

Hazard Evaluation

The hazard evaluation shall be performed initially without regard to the work performed in the space, for determination of permitting status as follows:

- Is the hazard exposure likely to be high? Yes ☐ No ☐
- Is there potential for uncontrollable changing condition? Yes ☐ No ☐
- Is an occurrence likely to occur? Yes ☐ No ☐
- Are the consequences of an occurrence high? Yes ☐ No ☐

This space has been determined to be: (check one):

Not a confined space ☐ Non-Permit confined space ☐ Permit Required confined space ☐

If a confined space, is the appropriate sign posted? Yes ☐ No ☐
If No, provide the appropriate sign to owner for posting. Sign provided? Yes ☐ No ☐

This space has been inspected and evaluated for the purpose of determining the permitting status as a confined space. Work in this space must be further evaluated prior to entry, as the status may change based on the work performed.

_____ Date: _____
DFRC Industrial Hygienist
Reviewed By: _____ Date: _____

DFRC-225
Dec 1999